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to the quantity of nitrogen it contains. This law is found to extend to those parts of plants which are not in solution in water, but which remain in their natural state of elaboration, only having their texture broken down.

The author is led to infer from his experiments that the chemical action to which any vegetable matter is naturally disposed, may, to a certain extent, be changed into some other, differing both in its kind and in its products; and that in order to effect such a change nothing more is required than to excite in other vegetable matter mixed with the former, some action which shall preponderate over the rest, so that the whole mass may obey this new and predominant influence. The vapour which is disengaged during the rapid decomposition of vegetable matter he finds to be highly noxious; and thence draws the inference that the Author of the universe has wisely ordained, that, when young plants, containing large quantities of nitrogen, are by any means checked in their growth, they shall be consumed by certain insects; which insects may be conceived to form one of the links of that harmonious chain which binds together all the parts of the universe.

The relation between the decomposition of vegetable matter and the growth of plants is apparent from the similarity of the influence of nitrogen on both these processes: this double function which nitrogen performs in favouring chemical decomposition by the roots of plants at the same time that it assimilates the matter thus formed in their other parts, is regarded by the author as another link in the same chain. In support of this view, he adduces the different chemical constitutions of the roots of the same plants when very young, and when fully grown. He finds that when plants have to perform the important offices of providing nourishment for the rapid growth of their young and tender shoots, they contain a quantity of nitrogen two or three times greater than that which they possess when fully grown; and he concludes by showing that, in accordance with these views, the seeds, roots and plants when placed in highly decomposing or decomposed matter, cease to grow, and under these circumstances, their germinating or vegetating power being superseded by the chemical action established in the matter which surrounds them, the whole becomes one mass of contaminated and infectious matter.

June 6, 1839.

FRANCIS BAILY, Esq., Vice-President, in the Chair.

George Barker, Esq., was balloted for, and duly elected into the Society.

A paper was read, entitled, "Experiments on the chemical constitution of several bodies which undergo the vinous fermentation, and on certain results of the chemical action." By Robert Rigg, Esq., F.R.S.

The special object of this paper is to show, first, that sugar is not constituted of carbon and water only; secondly, that during the vinous fermentation water is decomposed; thirdly, that neither pure carbonic acid nor alcohol is, in the common acceptation of the term, the product of this chemical action; and fourthly, that fermented liquors owe some of their valuable qualities to peculiar products formed during fermentation.

In order to trace the various chemical changes which occur in this part of his research, the author has had recourse to numerous experiments, the details of which are recorded in tabular forms. The first table exhibits the analysis of different kinds of sugar, honey, treacle, grape-juice and extract of malt and hops, the general result of which is that all these compounds contain oxygen in excess above the proportion in which it exists in water, and that they also contain a small quantity of nitrogen. He shows, by two independent modes of experimenting, that these bodies, when in solution, cannot be the only compounds undergoing decomposition during that fermentation, which has for its product spirit and carbonic acid; and in proof of this proposition he recapitulates the different elements in the compounds at the commencement and at the conclusion of the experiments. He finds that when the proximate elements are made the subject of calculation, the weight of the alcohol (constituted of two equivalents of carbon, three of hydrogen and one of oxygen) added to that of the carbonic acid and undecomposed sugar, exceeds the weight of the sugar employed by about 7 per cent. On recapitulating the ultimate elements, he finds that the hydrogen and the oxygen in the compounds after the fermentation exceed their quantity in the sugar experimented upon, by 15 per cent. of the former, and nearly 14 per cent. of the latter; and as a proof that no material error is occasioned by the mode of experimenting, it is found that the difference between the quantity of carbon at the first and at the last is very small.

Having arrived at these conclusions, the author infers from his experiments that the water of solution is decomposed by the carbon of the dissolved vegetable matter, in every case of the vinous fermentation, and in proportions proximately represented by the following formulæ: viz.

2 equivalents of the carbon of sugar	6·12	.....	12·24	} 14·24 olefiant gas.
2 equivalents of the hydrogen of the water 1·		.....	2·	
1 equivalent of the carbon of the sugar...	6·12	.....	6·12	} 22·12 carbonic acid.
2 equivalents of the oxygen of the water... 8·		.....	16·	

This decomposition he conceives is brought about by the influence of nitrogen, a very small quantity of which enters into the constitution of the olefiant gas, forming the base of all spirituous fluids of the alcohol and ethereal kind; and thus each compound experimented upon, forms these products in proportion to the quantity of carbon which undergoes chemical change, whether that compound be sugar, soluble parts of malt, grape-juice, or any other body.

The author proceeds to inquire into the constitution of the pro-

ducts which result from this chemical action. He finds the gas which is given off to be composed of carbonic acid, mixed with a small proportion of carburetted hydrogen; and the spirit, when subjected to careful analysis, to resolve itself into carbonic acid, water, and a very small proportion of nitrogen: and in further proof of the existence of this last-mentioned element in spirit, the author has recourse to the ultimate analysis of the charcoal obtained from alcohol and olefiant gas, a mode of experimenting which he conceives is less liable to error.

He states that the views thus sought to be established are confirmed, not merely by these direct experiments, but likewise by other changes which fermented liquors undergo on being kept under circumstances favourable for further chemical action; and that having proved the existence of such a compound as one constituted of carbon, hydrogen and nitrogen, and shown that water is decomposed during its formation, he thinks we are enabled to account for many other changes which occur during the decomposition of vegetable matter and the growth of plants: whence he proceeds to show that evidence of the presence of such a compound as the above in fermented liquors is afforded by the changes which take place in consequence of keeping them.

On subjecting to ultimate analysis the semi-fluids obtained by exposing fermented liquors to a temperature of 110° Fahr., the author found a decided difference between the chemical constitution of those procured from old, and those from new vinous fluids; and on searching for the law by which these differences are regulated, he found that the spirituous part entered into such combination with the excess of oxygen before referred to, and the undecomposed vegetable matter, so as to form with them new compounds.

After experiencing some difficulty in effecting a separation of these newly formed bodies, he found that while rectified pyroxylic spirit, of the specific gravity from 830 to 835, scarcely dissolved an appreciable quantity of the extract of malt and hops, considerable portions of the semi-fluids obtained from old ale and old porter were, by agitating, dissolved therein. By using this spirit as a solvent he effected such a separation as enabled him to discover decided differences between the proximate chemical constitution of the semi-fluids obtained from old ale and old porter, and those from liquors of the same description when new.

In accounting for many of the phenomena which accompany the vinous fermentation, the author observes that the small excess of oxygen found in all these compounds, which undergo this chemical action, is an essential and indispensable circumstance; a conclusion which is corroborated both by the formation of these new compounds which have been described, and by the generation of the acetic, tartaric, or malic acid, which is found in fermented liquors at all times, and in quantities varying according to the situations under which these fluids have been kept.